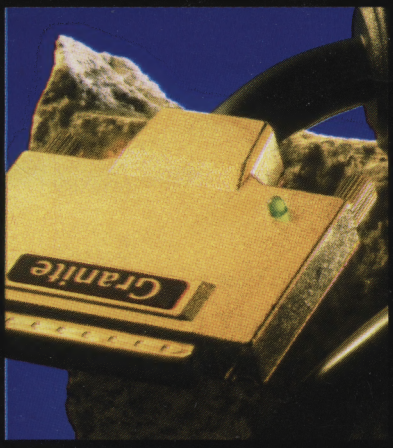
Granite Digital

INSTRUCTION MANUAL

SCSI *Vue* Terminator

Active Diagnostic Terminators



SCSI *Vue* *Gold* Cable

Gold Diagnostic Cables

Granite

D•I•G•I•T•A•L

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Section-1

Since its inception over 10 years ago the SCSI (Small Computer System Interface) has evolved into a popular industry standard. With this evolution, performance has been improved by a factor of over ten fold. Data transfer rates now approach 40 MBytes/Second, but with this increase in performance it becomes crucial to use only the best quality cables and terminators.

The SCSI Bus is designed to have both ends physically terminated. Diagram 1 shows a standard SCSI configuration.

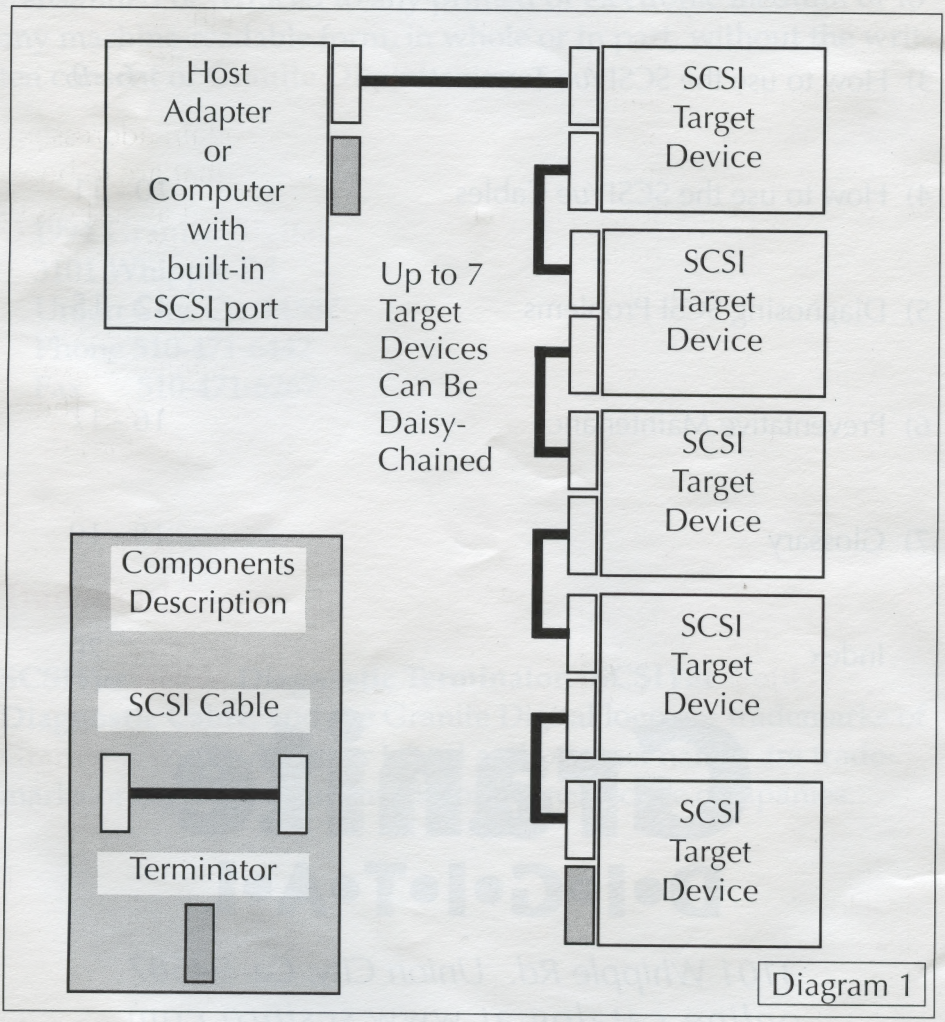


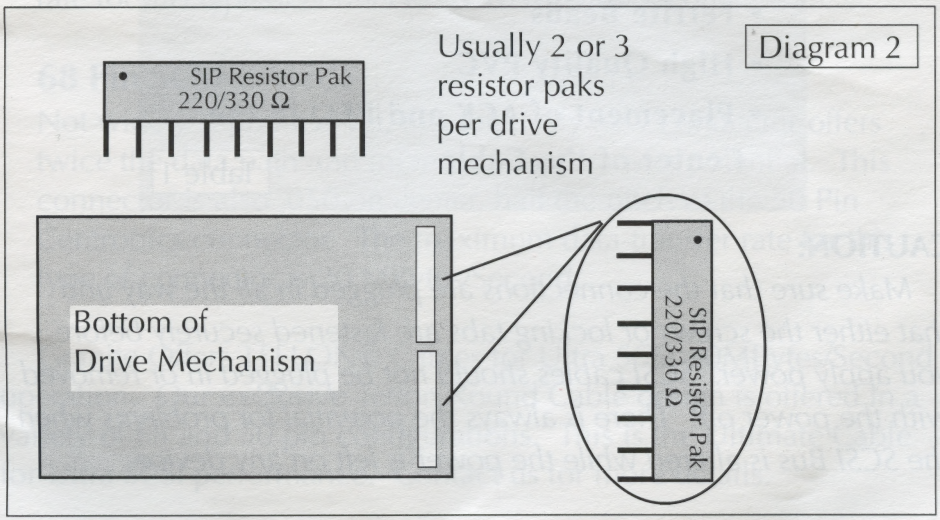
Diagram 1

The SCSI specification states that you can have one host and up to 7 targets connected to a SCSI Bus. You must terminate both the host and the last target device on the daisy chain. The cables should not have a total length of over 20 feet. Use the shortest cables available to keep this distance less than 20 feet.

Each SCSI device attached to the SCSI daisy chain must have a different address. The host adapter will usually occupy address 7, leaving address 0 through 6 for the attached target devices. With an external drive the SCSI address can usually be set on the back of the drive sub-system, or if you are using an internal drive, refer to the owners manual for the jumper settings.

Some systems require a target device to be at a certain address in order to work correctly. This is common with drives that are to be boot devices. Most host adapters require them to be set at address 0. Some UNIX systems have special addresses set for Tape Drives and CD-ROMs. Refer to their individual manuals for details.

It should also be noted that most internal drive mechanisms come with internal terminators already installed. These terminators take the form of 2 or 3 single in-line resistor paks (See Diagram 2). These terminators are socketed and easily removed. The color of these resistor paks is usually black, red, blue, or yellow.



The SCSI specification states that 6 meters (20 feet) is the maximum total length of a standard SCSI daisy chain. But, what is sometimes not taken into consideration are the added lengths of wire that are inside most SCSI sub-systems. If you use 9 inches as an average length, with seven devices attached, you would be left with only 15 feet of external cabling available before you exceeded the specification.

Another important consideration is the quality of the cable used. As you add target devices the need for higher quality cables increases. Cables that incorporate most or all of the features described in Table 1 have the greatest chance of offering reliable data-transfers. Table 1 lists some quality guidelines.

High Quality SCSI Cable Features:

- **26 Gauge Twisted Pair**
- **Foil and Braided Shielding**
- **Impedance of 100 Ω (+/- 10%)**
- **20u" Gold on Contacts**
- **20u" Gold on Shell**
- **Extra Heavy Duty Strain Relief**
- **Ferrite Beads**
- **High Quality PVC**
- **Placement of ACK and REQ in the Center of the Cable**

Table 1

CAUTION:

Make sure that the connections are plugged in all the way and that either the screws or locking tabs are fastened securely before you apply power. SCSI cables should not be plugged in or removed with the power on. There is always the potential for problems when the SCSI Bus is altered while the power is left on any device.

To further maintain reliability for any SCSI daisy chain, isolate the cables from other wires, and keep the cables away from other sources of power or data signals. Try to eliminate any electrostatic or electromagnetic effects that other cables might supply. Also, keep the cables from making excessively sharp bends. The most common reason a cable goes bad is from putting undue strain on it while making bends.

There are three basic cable connector types that have been accepted by the SCSI community.

50 Pin Centronics

Used in many of the external sub-systems, this is the most popular type of SCSI connector on the market. It is designed for SCSI-1 and some SCSI-2 applications. It has a maximum data-transfer rate of around 10 MBytes/Second.

50 Pin SCSI-2

Used mainly in the workstation environment, SUN officially made this the connector of choice for many of their new lines of SparcStations. These connectors are .050 on center, half the pitch of the 50 Pin Centronics connector. The maximum data-transfer rate for this type of connector is 10 MBytes/Second.

68 Pin SCSI-2 Wide

Not widely supported yet, this relatively new connector offers twice the data path and increased data-transfer potential. This connector is also .050 on center, half the pitch of the 50 Pin Centronics connector. The maximum data-transfer rate for this type of connector is 20 MBytes/Second.

Granite Offers TEFLON® Cables for Ultra SCSI 40MBytes/Second operation. Our exclusive Teflon Round Cable design is offered in a variety of 68 and 50 pin configurations. This is the Ultimate Cable for Ultra SCSI performance. Contact us for more details.

Section-3

Not only is the SCSIVue Diagnostic Terminator the best ACTIVE Terminator on the market, it is also a diagnostic analyzer that indicates where SCSI problems originate. The SCSIVue Active Diagnostic Terminator is a diagnostic tool that can save you countless hours when diagnosing your SCSI system. The four indicator LEDs show you what is happening on the SCSI Bus at all times.

Active termination is considered the best terminator solution for SCSI-2. Since it regulates the SCSI Bus, you have a much higher degree of reliability. The terminators active regulation maintains a constant 2.85 volts while sourcing current to the signal lines at 24ma. This stable environment helps create safer, more reliable data-transfers and offers a higher immunity to noise.

The SCSIVue Active Diagnostic Terminator also incorporates 20u" gold connectors and contacts to improve on conductivity and reduce inductive mismatches.

CAUTION:

When plugging in the SCSIVue Terminator make sure all power is turned off. Damage may occur if you plug in or remove SCSI devices while the power is turned on.

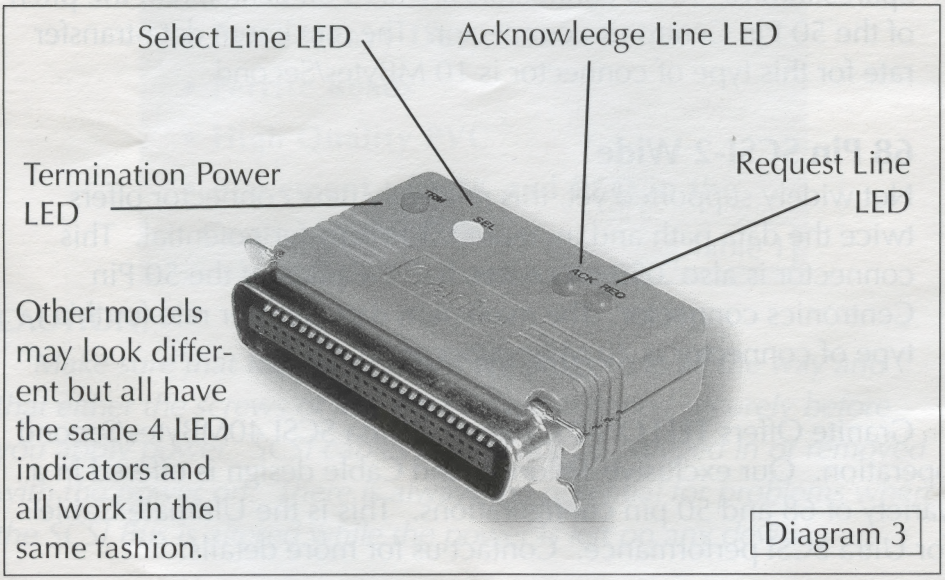

Select Line LED
Acknowledge Line LED
Termination Power LED
Request Line LED
Other models may look different but all have the same 4 LED indicators and all work in the same fashion.

Diagram 3

Termination Power (TRM)

The Termination Power Indicator should always be on. This indicator shows that Termination Power is being supplied to pin 38 on the SCSI cable. The SCSI Bus will not operate properly if this light is not on. The SCSI specification does not require all targets to supply power to this line and should the host (initiator) lose the ability to supply power to the bus, data-transfers will no longer be possible. Some older hosts (initiators) did not supply termination power and relied on the targets to do this. This produced another problem when no one supplied termination power. Today most hosts and targets supply this power and the problem has been remedied.

Select Line (SEL)

The Select Line indicates when a device has been selected and is either receiving or sending information to the host. This LED is on whenever there is activity on the SCSI Bus. The Select Line is on in conjunction with the ACK and REQ lines and should be blinking as the state of the SCSI Bus changes.

Request Line (REQ)

The Request Line is considered a clock line and it operates at very high speeds. It is critical to the operation of the SCSI bus and when operating seems to be dim because of the speed in which this line is turning on and off. The line represents the target requesting a response from the host (initiator).

Acknowledge Line (ACK)

The Acknowledge Line is also considered a clock line. It indicates that the host (initiator) is responding to the targets request. The LED is also dim in normal use due to the high speed of this clock line. Proper operation is indicated by a dim LED when there are data-transfers or when the SCSI Bus is active.

LED Indicators

The SCSIVue Active Diagnostic Terminator can tell you the state of the SCSI Bus after a computer crash. If your computer crashes, DO NOT TURN OFF THE POWER until you examine the LED Indicators on the SCSIVue Active Diagnostic Terminator. Table 2 lists the conditions of the SCSI Bus.

Tips on Detecting Errors

The SCSIVue Active Diagnostic Terminator indicators give you a starting point on what to look for when something goes wrong. To become familiar with its operation, it is recommended that you connect the Diagnostic Terminator to a known working system and learn what the indicators do during different states of SCSI Bus activity.

The main states to become familiar with are the following:

- When you initially boot the computer from the SCSI drive.
- When nothing is going on, the computer is idle, and nothing is being transferred via the SCSI Bus.
- When you are writing a file to a target device.
- When you are reading information from a target device.

SEL LED is on.	Activity is on the SCSI Bus.
TRM LED is on.	Termination Power is supplied on the SCSI Bus. This is the proper status of the SCSI Bus during a bus free state.
REQ LED is on.	The target is requesting a response from the initiator.
ACK LED is on.	The initiator is acknowledging the targets request.
SEL, TRM, REQ, ACK LEDs are on.	The target device is hanging the SCSI Bus.
SEL, TRM, REQ LEDs are on.	The initiator is hanging the SCSI Bus.
SEL, TRM ACK LEDs are on.	The initiator is hanging the SCSI Bus.
SEL, TRM LEDs are on and all other LEDs are off.	The target is waiting for the next command from the initiator, or the target is reconnecting and hanging the SCSI Bus.
All LEDs are off.	No activity on the SCSI Bus and there is no Termination Power... power is off.
TRM LED is on and all other LEDs are off, but the system is locked.	The target is waiting for the next command from the initiator.

Table 2

Section-4

SCSI*Vue* Gold Diagnostic Cable

Cabling is one of the most critical issues associated with good data-transfer on the SCSI Bus. For many years suppliers have been able to sell inexpensive non-shielded cables into the market with good success. The reason for this is that SCSI was originally very slow, especially in comparison with today's blistering SCSI speeds. Since data-transfers were happening so slowly you could get away with inexpensive non-shielded cables.

Today, with the advances that have taken place in SCSI technology, the quality of the cables has become one of the most important factors in determining both good reliability and high performance. The following section will describe how to use the SCSIVue Cables to help increase performance while maintaining a reliable data-transfer rate.

The SCSIVue Gold Diagnostic Cables have the quality materials and design needed for today's high performance specifications. Built into each cable is a diagnostic indicator that tells you if good connection is being made by all the previous connectors in the SCSI daisy chain. This indicator also tells you that the SCSI Bus is properly supplying termination power. Termination power is necessary to guarantee reliable data-transfers.

How To Use The Diagnostic LED

Since this cable is capable of telling you if termination power is being supplied, you can use it as a diagnostic tool to test both drives and other cables. The testing capabilities are limited. The cable can only give you a limited amount of information about other products, but it is far better than nothing and far cheaper than a $12,000.00 SCSI Bus analyzer.

Testing Cables

To test cables you must have an external sub-system available and the host computer. Plug the cable you are testing into the host and into the sub-system. Plug the SCSIVue Cable into the other connector on the sub-system. Leave the power to the sub-system off. Now, turn on the power to the host computer. The green LED on the SCSIVue cable should light. If it does, you know that you are getting both proper termination power and good conductivity in the cable you are testing.

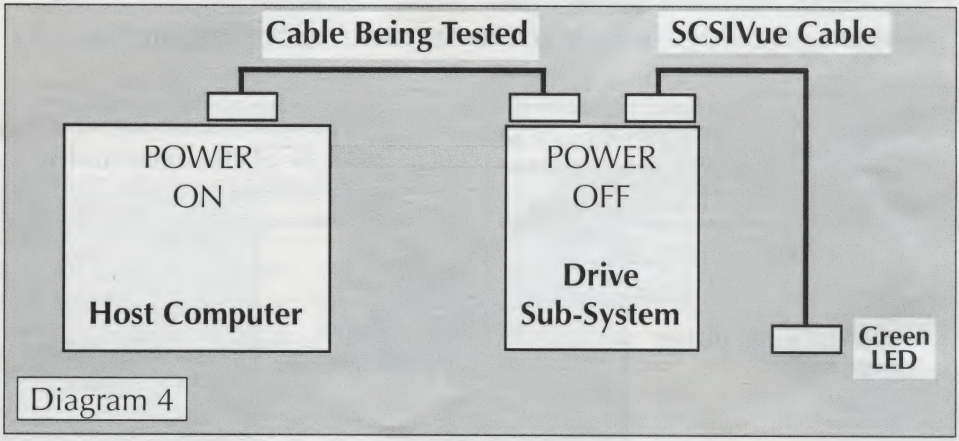
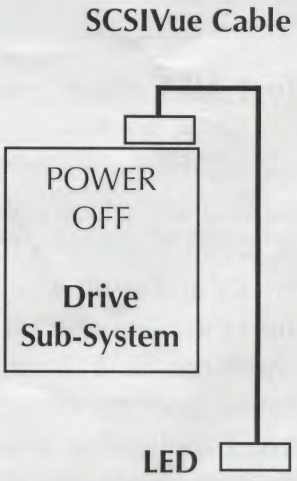


Diagram 4

Testing Drives

To test if your drive is supplying proper termination and if the connectors are making good contact, you simply plug the SCSIVue Cable into the suspect drive, power on the drive and check the green LED. If the LED is on then the drive is supplying proper termination power and the connectors are making good contact. If the LED does not come on, you have a problem in the drive. This is usually a small fuse attached to the drive mechanism. This fuse is not easily removed, and the drive mechanism should be sent back to the manufacturer for replacement.



Diagnosing SCSI problems is best done in a logical fashion. It is next to impossible to figure out exactly what is causing a problem if you have everything connected... so the best way to diagnose a problem is to simplify your test setup. This is done by disconnecting everything and starting with only one device connected.

Working with one device at a time is much easier than trying to figure out what is going on when you have multiple devices connected with multiple cables and terminators.

What we will do first is to take the host computer and connect a cable and a known working drive. The SCSIVue Active Diagnostic Terminator should be connected to the drive. (See Diagram 5.)

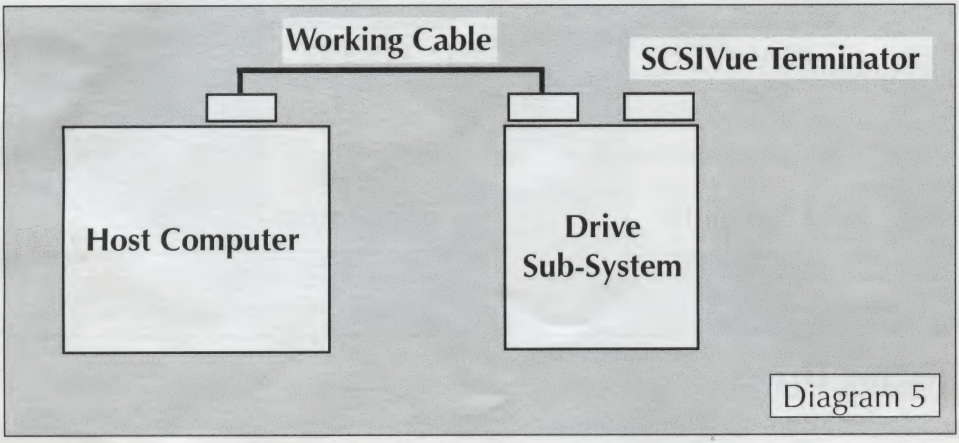


Diagram 5

Test All Cables

Cables are the easiest part of the system to test. After you have a system running, with a minimum configuration, remove the working cable and replace it with another cable you want to test. Use the SCSIVue Terminator to help test the cables. Turn the computer on briefly and verify that the TRM (Termination Power) LED illuminates. Turn the computer off then turn on the drive sub-system. Again, check the TRM (Termination Power) LED and make sure it illuminates. Boot up the system and copy some files to the sub-system, a small application is good to copy since you can start it up and see if the copy works like the original. Verify when you start to copy to the

drive sub-system that the SEL (Select Line) LED illuminates. Also the REQ (Request Line) and the ACK (Acknowledge Line) LED should illuminate dimly. They should be flashing so fast that they look dim. If the copy worked correctly and the LED indicators worked correctly then this cable is good. Continue with the next cable.

After testing all the cables, visually inspect them to make sure the contacts are all straight and clean. Make sure there is no obstruction keeping any of the contacts from making a good connection. Check around the strain relief area for any cracks or breaks, (See Diagram 6.)

If you find any kind of oxidation on the cable contacts use a pencil eraser to clean them, but do not rub too hard or you will remove

Check for cracks and breaks around the strain relief. To promote longer life try not to bend the cable too much. The strain relief can only do so much to protect your cable.

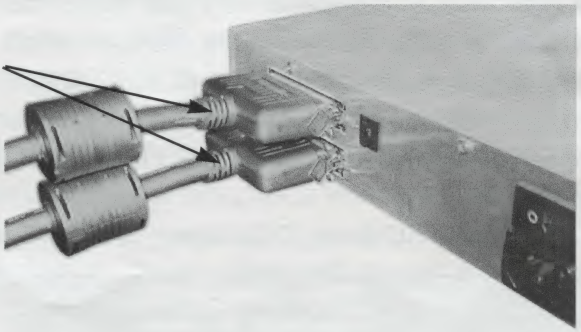


Diagram 6

some of the gold plating on the contacts. Check all the connectors on any target devices. Again, if you find the connectors oxidized clean them gently with a small pencil eraser making sure to remove any residue left from the eraser.

Test All Target Devices

Now that the cables have been tested you can next test all the SCSI Target Devices. The first thing to do before testing the hardware is to make sure that your operating system is not creating problems. Quite often the problems associated with SCSI are software conflicts. Since we are only testing hardware right now we must make it as simple as possible. So it's now time to remove all INITs (Macintosh), rename CONFIG.SYS and AUTOEXEC.BAT (DOS), and start with a fresh kernal (UNIX). The goal here is to test with only the basics.

After you have removed, changed, recopied, all the unnecessary items in your operating system, boot the system a couple of times without any external SCSI devices connected. Make sure that you have removed all device drivers and items that might cause conflicts. Now load in only the necessary device drivers that will allow you to test the target device that you will be connecting. You will again be testing one device at a time. Use one of the known good cables that you previously tested, and connect the suspect target device. (See Diagram 7.)

Connect the SCSIVue Diagnostic Terminator and power up the

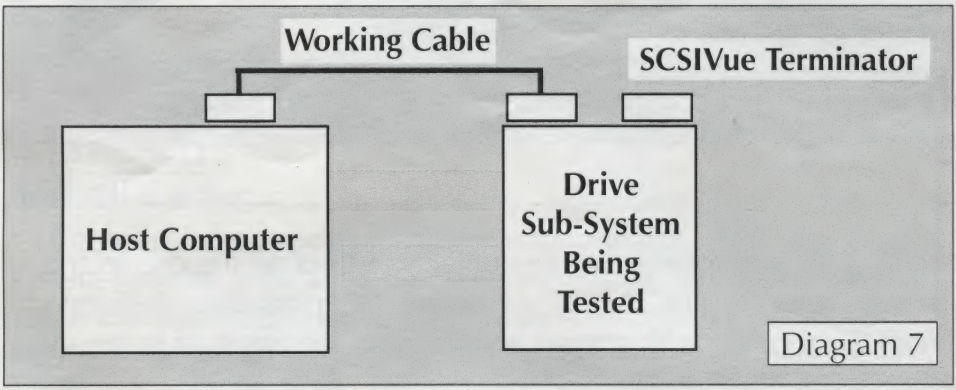


Diagram 7

computer only. Check the LED on the terminator and make sure that the TRM (Termination Power) LED lights up. If it does not, the computer is not supplying termination power. Check with the manufacturer of the computer or host adapter for service advice. (Some host adapters have removable fuses that can be replaced by the end user.

Take a look at the card to see if there is a removable fuse. Replace it and repeat the previous procedure.)

Now with the computer turned off, turn on the suspect target device. The TRM (Termination Power) LED should come on. If it does not, the drive fuse has also probably gone out. Call the manufacturer for details on how to fix the problem. If the LED goes on we can now proceed to the next step.

With both the host and target supplying termination power we can now turn them both on and try to operate the suspect device. Data transfers are the best way to tell if a device is working or not. If the device is a hard drive, tape drive, removable drive, floptical drive, or any other device that stores information, the simplest thing to do is copy over a few megabytes of information.

It is best to test data-transfers with a freshly formatted device that has been tested for bad blocks and is free of viruses. It is also useful to test a target device for a prolonged amount of time, thus testing for thermal problems that will only arise after hours of testing. If the device does not have any problems after such testing you can feel reasonably assured that the drive is operating properly. So, if possible, reformatting the device is a good safeguard against viruses and bad blocks. Both can create problems.

Using the SCSIVue terminator to help check how things are working can be done very easily. During the data-transfer state, you should be able to monitor the ACK (Acknowledge Line) LED, the REQ (Request Line) LED and the SEL (Select Line) LED. Both the ACK and REQ should be glowing dimly (actually flashing on and off very fast), and the SEL line should be on brightly. If this is not the case, then you have a problem with the host or target. Refer to our section on page 6 for more details.

Continue until all the SCSI targets have been individually tested. At this point you have tested all the SCSI components on your system. Now connect one device at a time and test the system as you add each device. If the system still fails as you add the last device then SCSI Cable quality should be suspect.

The SCSI Bus is a wonderfully versatile bus system that allows a large variety of devices to be attached to any computer. With this versatile bus structure there are a few things that will help maintain trouble free operation.

Hard Drives

The most common problems experienced with hard drives are:

• Software corruption. A program has crashed and taken with it some important information that the drive and file structure need to operate properly. The best solution here is to use a program like "The Norton Utilities", or a similar product to detect if the file structure and the integrity of the files are still in tact. Running a program like this every few hours of operation can eliminate most software corruption problems.

• Viruses. This is quickly becoming one of the most common reasons for system crashes. It is a very good idea to use an anti-virus program to eliminate the potential damage that can occur due to viruses. The best thing to do is to be very careful when copying programs from friends or bulletin boards.

• Bad Blocks. Bad blocks occur when either the drive has been dropped or shaken when running or simply when a small particle of dust has been trapped by the magnetic head and damaged a small spot on the surface of the hard drive platter. This is often called a crash and with it comes the realization that the file that was written on that small spot may no longer be valid. The best thing to do is to test the drive every month or so to make sure that no bad blocks exist. Most drive or host adapter manufacturers supply a utility that will allow you to test for bad blocks without destroying your data.

• Defragmentation. This will not so much create a problem with drive reliability as it will in performance. As you operate a drive and copy, erase, and recopy files to it, you create fragmentation. In other words the drive will copy files into whatever area is available on the drive, even if that area is not contiguous. This fragmentation causes the heads to have to move farther and take longer than they would if the file was contiguous. Defragmentation programs are available and are

part of most good drive maintenance programs like Norton Utilities.

Removable Drives

Very similar to hard drive, removable drives have an added problem. Dust contamination. The best preventative maintenance is to operate these drives in a clean environment. Never leave the cartridge inserted in the drive when not in use and always store the cartridges in their protective carriers. There are also cleaning kits available that allow you to clean and maintain the heads. These should be used as recommended by the manufacturer and most often in situations where dust is a problem.

Optical Drives

Optical drives are very similar in operation to removable drives, but you have the added advantage of being able to clean the cartridge. Cartridge cleaning kits will remove all unwanted dust and bring the cartridges back up to new specs, but be careful not to over use the cartridge cleaner. You can physically inspect the cartridges for dust by opening the protective sliding window on them.
DO NOT TOUCH THE PLATTER.

Tape Drives

Tape drives have two areas that are very important to maintain. The tape itself is only good for so many copies, and its shelf life is usually limited to a few years. The best thing to do with archives is to recopy them to new tapes after a couple of years. The tape mechanism itself is also an area where cleaning is imperative for proper operation. Most tape drive have capstan cleaning kits available, and these should be used periodically.

Scanners

Scanners do not need as much maintenance as hard drives, but there are some things you can do to guarantee good performance. The simplest thing to remember is that the glass does get dirty after time and must be cleaned to guarantee a good quality scan. Simply use Windex or other glass cleaner to maintain the cleanliness of the glass.

Access Time: The time it takes for a disk drives head to reach a sector after the issuance of a read or write command. Command overhead + seek time + latency = access time.

Address (SCSI): The ID number of a target or host on the SCSI Bus. Must be between 0 - 7, and no two devices can have the same ID number.

Average Seek Time: The milliseconds of time that it takes to do all possible seeks on a drive divided by the number of seeks possible.

Bit: The binary digit representation of 0 and 1. This is the basic language of computers, states of either ons or offs.

Block: Usually 512 bytes of information and a common unit that is transferred at one time to and from a hard drive or to and from ram memory.

Byte: A group of eight bits. This is the standard size unit for computer information.

CD-ROM: A storage device that is commonly used on computer systems. Holds up to 650 Megabytes of information. You can not write to a CD-ROM, only read from it.

CPU: Central Processing Unit: The heart of the computer. Usually one large integrated circuit.

Data-Transfer Rate: How fast a drive or other device can transfer bytes of information.

Device Driver: A piece of software that controls the operation of any attached SCSI device.

Firmware: Software instructions that are stored in ROM directly on the drive or SCSI device.

Fragmentation: With use over time, the sectors of a file are written in different areas across the platters surface. This slows access time.

Gigabyte: 1024 Megabytes

KB/s: Kilobytes per second, or 1,000 bytes per second.
Kb/s: Kilobits per second, or 1,000 bits per second.

MB/s: Megabytes per second, or 1,000,000 bytes per second.
Mb/s: Megabits per second, or 1,000,000 bits per second

Partition: A defined part of a drive that is allocated to a specific user or purpose.

Peripheral: A device (target) that is attached to the SCSI bus. It can also be any device attached to a computer system.

Platter: The disk that rotates inside of a drive and where the data is stored.

SCSI: Small Computer System Interface. A bus structure in which peripherals can be easily and quickly attached to a host computer.

Sector: An allocated amount of space on a platter. Usually 512 bytes per sector.

Tracks: Invisible magnetic "grooves," in the form of concentric circles that store data on a platter.

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50 - Pin SCSI 2 Connector, 5
68 - Pin SCSI 2 Wide Connector, 5
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Getting Extra Help

We have tried to outline most of the things that effect SCSI performance. Should you still have problems after installing our products and trying our suggestions you should contact the following companies.

The manufacturer of the Host Adapter.

The manufacturer of the SCSI Formatting Software.

The manufacturer of the Drive Sub-system.

The manufacturer of the Drive Mechanism.

The manufacturer of the Computer.

In most cases all of the above sources will have a technical support group that should be able to shed some light on where the problem lies. If all else fails you can contact **Granite Digital** customer support and we will try to help you find the answers. We work with most of the popular manufacturers and have a large database of manufacturers. We can also refer you to a variety of data-recovery service companies.

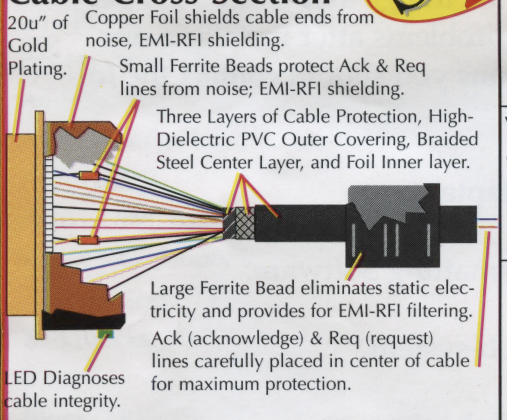
Granite
D•I•G•I•T•A•L

Quality Cables & Terminators

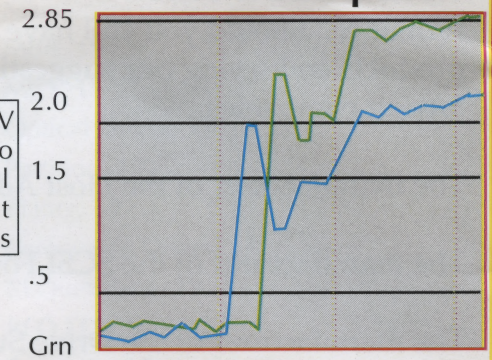
Gold Diagnostic Cables

Active Diagnostic SCSI

Cable Cross-Section


20u" of Gold Plating.
Copper Foil shields cable ends from noise, EMI-RFI shielding.
Small Ferrite Beads protect Ack & Req lines from noise; EMI-RFI shielding.
Three Layers of Cable Protection, High-Dielectric PVC Outer Covering, Braided Steel Center Layer, and Foil Inner layer.
Large Ferrite Bead eliminates static electricity and provides for EMI-RFI filtering.
Ack (acknowledge) & Req (request) lines carefully placed in center of cable for maximum protection.
LED Diagnoses cable integrity.

Terminator Operation



Diagnostic Indicator

- *Indicates Cable Integrity*
- *Good Connections on*

Contacts **Triple Shielding / Ferrite Beads**

- *Eliminates Cross Talk, Static, EMI, and RFI Noise*
- *Less Errors, Faster Performance*

Gold Connectors & Contacts

- *Better Conductivity*
- *Better Shielding*

Active Regulation

- *Improves SCSI Performance*
- *Less Errors, More Reliable Data Transfers*

Diagnostic Indicators

- *Diagnoses Problems*
- *Analyzes Signal Quality*

Gold Connectors & Contacts

- *Better Conductivity*
- *Better Shielding*

Granite D•I•G•I•T•A•L

Quality Cables & Terminators

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